

# University Physics 1A

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## Oscillation Experiment

$$\begin{aligned}F_{\text{by spring}} &= -kx \\ -kx &= F = ma = m \frac{d^2x}{dt^2} \\ \frac{d^2x}{dt^2} &= \frac{m}{m} \frac{d^2x}{dt^2} \\ &= -\frac{kx}{m}\end{aligned}$$

Assume  $x(t) = A \cos(\omega t + \phi)$ :

$$\begin{aligned}x(t) &= A \cos(\omega t + \phi) \\ \frac{dx}{dt} &= -\omega A \sin(\omega t + \phi) \\ \frac{d^2x}{dt^2} &= -\omega^2 A \cos(\omega t + \phi) \\ &\stackrel{?}{=} -\frac{k}{m} A \cos(\omega t + \phi) \\ \omega^2 &= \frac{k}{m} \\ \omega &= \sqrt{\frac{k}{m}}\end{aligned}$$

$A$  is the maximum value of  $x$ .  $\omega$  is the angular frequency.

$$2\pi = \omega T$$

$$T = \frac{2\pi}{\omega}$$

You can find all my notes at <http://omgimanerd.tech/notes>. If you have any questions, comments, or concerns, please contact me at [alvin@omgimanerd.tech](mailto:alvin@omgimanerd.tech)